

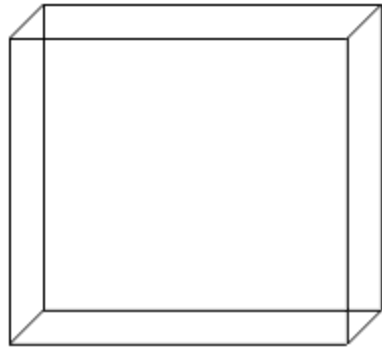


Earth Science!

Vocabulary:



**volume = the amount of space
an object fills**





Earth Science!

Vocabulary:



**mass = the amount of matter (stuff)
an object has in it.**

**mass is measured by how much
energy is needed to move
something, although on Earth
we use the word 'weight'.**

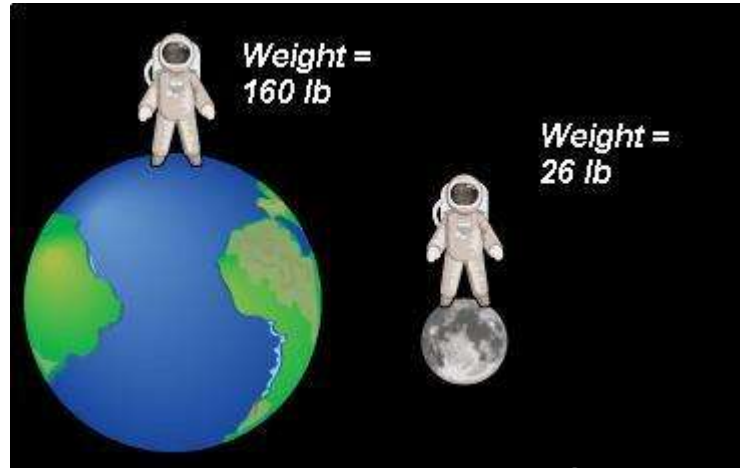


Earth Science!

Vocabulary:



weight = gravity pulling on mass



**The amount of mass you have is the same no matter where you are.
The amount of volume you have is the same no matter where you are.
Your weight depends on the size of the object pulling on you!**



Earth Science!

Vocabulary:



Density !

So, what is density?

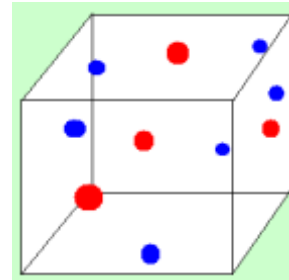
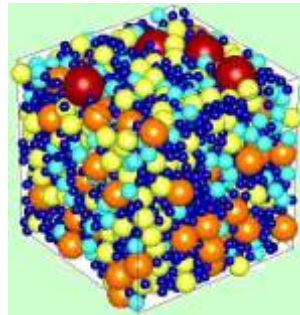


Earth Science!

What is Density??

Density refers to how much “stuff” (mass) there is in a given volume.

Something that is dense has more matter in a space than something that is not dense. It is how tightly packed the matter is.



More dense sinks and pushes up less dense! Less dense is BUOYANT



Earth Science!

What is Density??

Density refers to how much “stuff” (mass) there is in a given volume.

The formula for the density of an object:

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$



$$D = \frac{M}{V}$$



Earth Science!

What is Density??

Density refers to how much “stuff” (mass) there is in a given volume.

So, if a brick that weighs 10 pounds takes up one cubic foot, then

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$



$$\frac{10 \text{ pounds}}{\text{foot}^3} \text{ per}$$



Earth Science!

Vocabulary:



Density !

Density is a way to describe two substances (rock, water, warm air, cool air) to see which weighs more compared the same amount of the other.

Do you weigh more or less than the same volume of water? If you weigh less, you float!

Does a liter of warm air weigh more or less than a liter of cold air?

Does a liter of lead weigh more or less than a liter of popcorn?



Earth Science!

What is Density??

Density refers to how much “stuff” (mass) there is in a given volume.

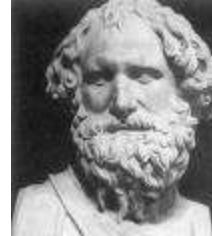
These mini-marshmallows float on top of the cocoa. Which is more dense, the cocoa or the marshmallows?





Earth Science!

Archimedes had a problem:



The King of Syracuse had given 1 pound of gold to a jeweler. The jeweler returned a 1 pound crown.

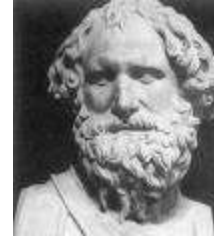


The king did not trust the jeweler. He thought that the jeweler had kept some of the gold for himself, and had mixed silver into the crown. Silver is less valuable than gold.



Earth Science!

Archimedes had a problem:



How could Archimedes test whether the crown was pure gold, or if it was mixed with silver?



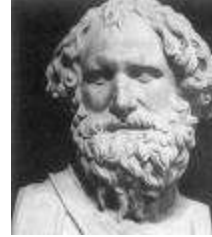
(Hint: he took a bath)

(and water splashed out of the tub)



Earth Science!

What Archimedes did:



He knew that gold is DENSER than silver.

Gold Density = 19.3 grams /cm³ & Silver Density = 10.5 grams /cm³

That means that a pound of gold is SMALLER than a pound of silver (only 1/2 as big!).

He put a pound of gold into a full bowl of water and saw how much spilled.



Earth Science!

What Archimedes did:



He then put the crown into that bowl of water. and saw that even more water spilled out.



The 1 pound crown took up more room than the 1 pound of gold – it was *less dense* than gold!

After that, the jeweler weighed one head less.





Earth Science!

What is Density??

WATER!

When the metric system was *invented*, WATER was used as the basic measurement of weight, volume and density



**1 cubic centimeter (1 mini marshmallow) of water =
1 milliliter of water =
1 gram of water**

and it has a density of ... ???



Earth Science!

What is Density??

BREAD and WATER!

**A slice of bread measures 1 cm x 10 cm x 10 cm = 100 cm³
It weighs 24 grams.**

Using the formula $D = M / V$, what is the density of the slice of bread?





Earth Science!

What is Density??

BREAD and WATER!

**A slice of bread measures 1 cm x 10 cm x 10 cm = 100 cm³
It weighs 24 grams**

Using the formula $D = M / V$, what is the density of the slice of bread?

$$d = 24 \text{ g} / 100 \text{ cm}^3$$

-or-

$$0.24 \text{ g} / 1 \text{ cm}^3$$

What is the density of water?

Will the slice of bread float?





Earth Science!

What is Density??

BREAD and WATER!

**Bread squished into a ball is $2\text{ cm} \times 2\text{ cm} \times 2\text{ cm} = 8\text{ cm}^3$
It still weighs 24 grams**

Using the formula $D = M / V$, what is the density of the ball of bread?



Earth Science!

What is Density??

BREAD and WATER!

**Bread squished into a ball is 2 cm x 2 cm x 2 cm = 8 cm³
It still weighs 24 grams**

Using the formula $D = M / V$, what is the density of the slice of bread?

$$d = 24 \text{ g} / 8 \text{ cm}^3$$

-or-

$$3 \text{ g} / 1 \text{ cm}^3$$

What is the density of water?

Will the slice of bread float?





Earth Science!

What is Density??

STEEL and WATER!

Working backwards from what you have just learned, how can we take

a chunk of steel or concrete

and make it float in water?



Earth Science!

What is Density??

STEEL and WATER!

Working backwards from what you have just learned, how can we take

a chunk of steel or concrete

and make it float in water?





Earth Science!

Vocabulary:



specific gravity = a RATIO comparing the density of an object to the density of water.

If something is less dense than water, it floats.

If it is more dense than water, it sinks.

And if something is the same density as water?



Earth Science!

Vocabulary:



specific gravity = the density of an object compared to the density of water.

What is the density of water?

Why would we care about specific gravity - whether something weighs more or less than an equal volume of water?





Earth Science!

What is Density??

We can also talk about “Population Density”.

Which area has a greater population density –

South Dakota



or

Tokyo

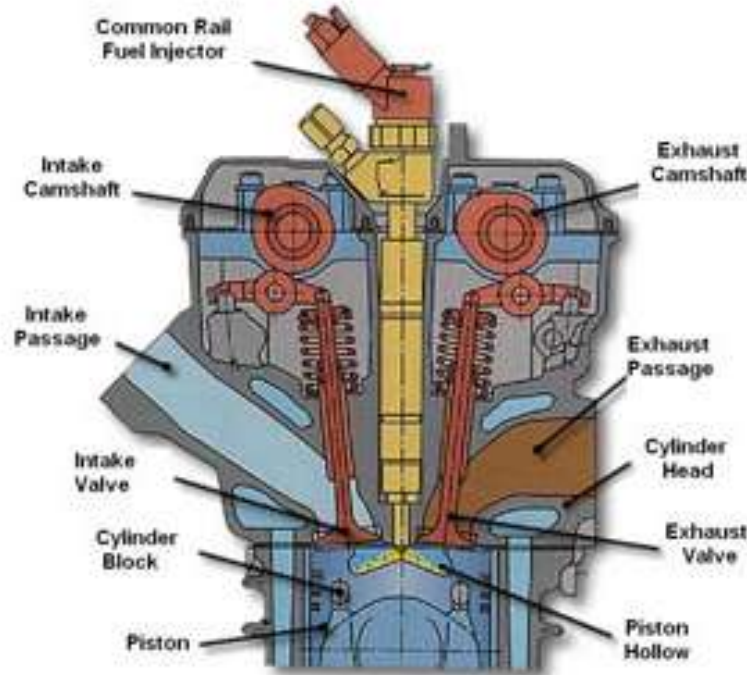




Earth Science!

What is Density??

We can also talk about the density of Heat Energy





Earth Science!

We can also talk about the density of Heat Energy

Canton Teen's Hands Amputated After 'Huffing' Propane

Hartford Courant (September 24, 2009) CANTON — - When police and EMTs arrived at a Dunne Avenue home Sept. 8, they initially thought that the 13-year-old boy was having an allergic reaction.

But they soon realized that the boy had been inhaling propane gas in an attempt to get high, and in the process he had suffered a severe case of frostbite to his eyes, mouth, throat and lungs as he inhaled the gas that comes out of its container at 40 degrees below zero. The boy also suffered serious tissue damage.

The boy was rushed to Connecticut Children's Medical Center in Hartford, where he was placed in a medically induced coma, Canton Police Chief Lori Coppinger said. The boy had to have both hands amputated, she said.



Earth Science!

We can also talk about the density of Heat Energy

And Remember that Second Hand News Can Not Be Believed!

Hartford Courant (September 28, 2009) - The father of a boy injured while inhaling propane on Sept. 8 said Sunday that he was angry to read in The Courant that his son's hands had been amputated.

"It's all wrong," the father said of the story.

One of the boy's hands was injured, but not as severely as reported. "He's doing well," the father said. "He's making a full recovery. There's no scarring even."

The boy did sustain frostbite "burns" to three fingers on his right hand, but they are expected to heal completely, his father said. The boy also sustained injuries to **his mouth, but not to his eyes or lungs**, according to the father.



Earth Science!

Quick Check:

Salt water contains more than just water – there is salt and many other minerals dissolved in it.

As a result, salt water is HEAVIER than fresh water. So, could you float easier in fresh water or in salt water?

WHY?





Earth Science!

So why care about Density??

Density describes how much something weighs compared to the same volume of something else.



More dense sinks and pushes up less dense!

- Things expand as they get warmer (you can loosen a tight cover on a jar by running it under hot water).
- Air expands as it gets warmer, and it since it is now less dense than cold air, it floats on cold air (warm air rises). This creates our weather.
- Basalt is denser than granite. This creates tsunamis and volcanoes.
- Cold water is denser than warm water and sinks. This creates ocean currents (until the ice caps melt).
- Helium is less dense than air. This creates happy children

